

Evaluation and development of digital competence in future primary school teachers at the University of Murcia

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RESUMEN

This paper presents the findings of a study carried out in the academic year 2014-2015 at the faculty of Education of the University of Murcia with first year degree students in Primary Education studying Research and ICT. The study started with the application of the DIGCOM questionnaire to analyze the digital competences of 134 students. The questionnaire served as an initial task to help students reflect on their digital competences. The subject was developed around tasks which adopted a transversal approach and used the nature of the contents itself to direct and improve students' digital competencies. Finally, the initial questionnaire was reformulated and run in order to ascertain the students' self-perception of their improvement in these competencies through the tasks they had performed.

Below we present the tasks carried out, the organization of each subject and the most relevant data regarding the self-perception of digital competencies of the future primary school teachers enrolled at the University of Murcia. The data reveal, on the one hand, that the students participating consider themselves to be competent in the most basic aspects of digital competencies and, on the other, their perception that the work done in the subject has helped them quite a lot in improving their competencies.

PALABRAS CLAVE: FUTURE TEACHERS, DIGITAL COMPETENCIES, DIGCOM, UNIVERSIDAD

1 INTRODUCTION

In the last decade training through competencies has become one of the essential elements at all levels of education. Competencies are today the backbone of educational planning and action, from the outset through to universities and in ongoing education or workers and areas of non formal education. The current Education Act in Spain establishes in its third chapter that a part of the curriculum is to include: "The competencies and capacities for the integral application of the contents proper to each teaching and education stage in order to ensure the appropriate performance of activities and the effective resolution of problems" (LOMCE, 2013, p. 10; our translation).

The concept of competence is a complex one. It implies putting into effect actions that may often be confused with similar concepts, such as strategy, expertise and ability (Cebrián & Junyent, 2015). One of the most complete definitions in our opinion is that put forward by Escudero (2008) in which competencies are understood as "descriptions of students' learning that include multiple ingredients (cognitive resources of diverse nature - personal, social, values), and the capacity to mobilize and integrate them in order to define and respond appropriately to complex situations and problems in relatively well defined contexts, taking into account established social and ethical criteria". Competencies can be many and varied (Peklaj, 2015). In this paper we focus on digital competence because of its presence and importance at all levels of education, from compulsory education (where it is one of the 8 basic competencies) through to university. We agree with Levy (2010) that a feature of the labor markets is that technology advances faster than personal skills, and while we may not be sure exactly how it will evolve, we can be certain that computers are key technology so we must invest in developing the appropriate competencies.

The concept of digital competence is one of the most dealt with in the literature, with many authors providing compilations and approaches (e.g., De Pablos, 2010; Fraser, Atkins, & Richard, 2013; Gutiérrez, 2011; Janssen, Stoyanov, Ferrari, Punie, Pannekeet, & Sloep, 2013; Suárez, Almerich, Gargallo, & Aliaga, 2013; Prendes, & Gutiérrez, 2013; Gutiérrez, Prendes, & Castañeda, 2015). We also find various national and international bodies and institutions which have addressed the issue (Association of College and Research Libraries Information Literacy Competency Standard, 2000; CRUE-TIC & REBIUN, 2009; ISTE, 2008; Chilean Ministry of Education, 2006; OCDE, 2011; UNESCO, 2004; VOX, 2008).

Thus paper takes as its starting point the European Commission publication in 2013 *DIGCOM: A Framework for Developing and Understanding Digital Competence in Europe*, which aims to provide a framework for developing and understanding digital competence in Europe. The project took digital competence to be users' capacity to make safe, critical and creative use of ICTs to fulfill aims related to work, employability, learning, leisure, and inclusion and/or participation in society (Ferrari, 2013). On the basis of DIGCOM work has been done to create a detailed framework for the digital competence of all citizens using a detailed description of the competencies that are needed to function in today's society. This set of competencies, which covers various

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levels is the starting point of our study and it has enabled us to approach the digital competence knowledge of first year students on the primary school teaching degree course.

2 DEVELOPMENT OF THE SUBJECT

Our study was performed within the Research and ICT subject first year degree course in Primary Education. The subject is worth 6 credits and it is part of Basic Training. The subject is taught jointly by two departments, and this ICT centered experience (8 weeks) is the responsibility of the Department of Didactics and School organization. The aim in this area of the degree is for the students to study in depth gain the criteria for integrating ICTs into teaching and the methodological tools and strategies commonly used in teaching and learning, so providing them with a richer preparation as future primary school teachers. The work was based on group tasks as this methodology has proved to be the most suitable in recent years for developing students' competencies (Aslan & Zhu, 2015; Maltseva, Kolomiets, Glizerina, Kurochkina, Andreeva, & Shestakova, 2015; Litovchin, Avilova, Podvoiska, Valeyev, Yesina, Gataullina, & Islamova, 2015; Sanaiey, 2015; Woodruff, Martin, & O'Brien, 2015). Thus the proposed working methodology places the students at the centre of process, making each of them an active individual while attempting to act at all times as an emancipator.

Due to the very nature of the subject, ICTs were both an object of study and a means of expression, communication and presentation of the tasks carried out, which meant that all the work performed could lead to improving the digital competencies as well as enabling the student to develop competencies proper to the subject itself.

The tasks were designed taking into account key topics related to ICTs that today's primary school teacher should master. These included the knowledge society, Web 2.0, integrating ITCs into the primary school classroom, Social Networks and Personal Learning Environments (PLE) for teacher training.

The work was planned so as to be carried out in groups of 3 or 4 students. The tasks were introduced and explained in class by the teachers and the students were given a week and a half to carry out each one. They made use of class time and self-study time, as set out in the teaching guide. Each group had to maintain a blog during the course where they periodically published the results of the tasks they had performed.

Below we detail the five tasks proposed and carried out by the students:

Task 1: Educational questions in the knowledge society

The aim of this task was for the students to learn about the knowledge today's society has of ICTs and education. Students were expected to reflect on a series of educational questions proposed by Bartolomé & Grané (2013) in their article "Interrogantes educativos en la sociedad del conocimiento". Each group had to find an image (under Creative Commons license) that significantly illustrated and represented each question and add a key word or idea that fostered a better reflection of the question represented. The images could be edited provided the license permitted this. To help the students in this task, they were given a text to work with and basic information on Creative Commons Licenses.

Task 2: Web 2.0.

In this task the groups built a digital artifact (of 3 minutes max.) using VoiceThread (<https://voicethread.com>). The aim here was

to explore the educational possibilities Web 2.0 offers and to try to convince other teachers of the advantages of using Web 2.0. tools. The production had to indicate the importance of Web 2.0 in the educational sphere and explain the use that could be made of a Web 2.0 tool that each group had been randomly assigned.

One of the possibilities of VoiceThread is that it allows commentaries to be left on the publications made, so each group had to visit and comment on the work done by at least three other groups. Students were provided with basic documentation on the concept of Web 2.0. Tools assigned to the groups were Mendeley, Scoop.it, Unhangout, Padlet, Storify, Thinglink, Moovly, among others.

As a final product of the task each group had to include the URL of the digital artifact made in its blog along with a brief description of the comments made to other groups.

Task 3: Enriched cognitive processes with ICT.

In this task the groups were fully committed to the integration of ITCs in teaching-learning processes. The aim was to consider how the various cognitive processes that students use when learning can be enriched by ITCs.

Our starting point was a text by Prendes, Gutiérrez & Castañeda (2015) "Educación conectada en un mundo 2.0". After reading and analyzing the text, the groups were required to select a topic from the Primary Education curriculum and study how they would work with it with and without ICTs, indicating the cognitive processes that would be set in motion in each case. They then prepared a PechaKucha (oral presentation accompanied by a visual presentation of 20 slides of 20 seconds duration each) which they uploaded to the Internet and presented in the classroom.

Apart from the base text, the students could draw on resources and materials about how to design oral and visual presentations.

Task 4: Dynamics for safe use of social networks.

Students got to know social network tools and how to use them safely. The task consisted of the groups' designing an original dynamic for awareness, understanding and good use of social networks with a certain group of users (4 or 5 people). The main content and concepts worked on in this task were online social networks and digital identity, and students were recommended to look up these terms prior to designing the dynamic in reading materials provided to them (Castañeda, González, & Serrano, 2011; Castañeda, & Gutiérrez, 2010).

The proposal was to have a duration of approximately 30 minutes and instructions were printed in a poster made using an online tool. In face to face classes the groups took turns to put their ideas into operation, with their fellow students acting as participants and assessors, using assessment rubrics provided. Each group had to put the poster of their dynamic on its blog together with the evaluation it had made of another group.

Task 5: Discovering our PLE

The final task sought to help students to discover the concept of PLE and its implications in professional teacher development. Once students had been introduced to the idea through recommended texts (Castañeda & Adell, 2013), they had to prepare an interview in order to ascertain the PLE of one of their classmates. When they had gathered the information on their classmate, they then represented the person in a concept map. Each group was required to include on their blog the interviews, concept maps and a reflection on the PLE of each component after seeing their own PLE drawn up by a classmate.

3 METHOD AND INSTRUMENTS

The aim of our study is to ascertain the perception of first year Primary Education degree students about their own digital competence before and after taking the ITC subject. This overall aim can be broken down into:

- Describe the students' perception of their digital competence as measured by the DIGCOM questionnaire administered at the beginning of the ICT block.
- Design and implement a series of tasks aimed at improving students' digital competence.
- Ascertain the opinions of the students as to how their digital competence has changed in terms of the areas of competencies considered in the DIGCOM questionnaire after performing the tasks.

Given these aims, the methodology proposed is quantitative and descriptive and a questionnaire is used to collect the information sought.

As stated earlier, two questionnaires were administered. The first was the DIGCOM, which comprised 89 items grouped into five categories: information, communication, creation of contents, safety and problem solving.

The second questionnaire was an adaption of the first and included for each task, and in relation to the five blocks making up the DIGCOM, the following statement: "Task X has helped to improve my competence in area X". Together with the area indicated, we included a summary of its essential elements and asked the students to review first their first reflection regarding their digital competence made at the time of the first questionnaire. The second questionnaire comprised 25 items, with five response options: "totally agree; agree; neither agree nor disagree; disagree; totally disagree."

To facilitate the administration of the questionnaire and later analyses, both questionnaires were administered through Google Drive.

4 RESULTS

Below we present our main findings after analyzing the data from the two tools used.

4.1 Ethnographic data

134 students participated in the experiment, the large majority of whom were female (76%). The mean age was 19 years and the youngest age was 18, as was the mode, while the maximum age was 39.

4.2 Questionnaire on self-perception of digital competence (DIGCOM)

This questionnaire comprises 5 blocks in which students were asked about their self-perception of different aspects of their digital competence. The blocks were: information, communication, creation of content, safety and problem solving. Below we present the most significant data for each of the blocks.

In the area of **information** various aspects were rated. These referred to access, search, management, etc. of information. 94% of the sample stated they were able to use search engines online; 97% declared that they knew how to save and store files and contents; and 98% were able to retrieve contents saved in their computers.

When surfing the Internet for information and searching for information online, 97% claimed they were able to do this and 94% stated they were able to select appropriate information from that available on the Internet. In relation to this, we would highlight also that 91% of the students declared that they were able not only to select information but also to compare different sources of information.

As regards their confidence in the information on the Internet, 91% stated that all the information found is reliable. Furthermore, 79% were critical of the information they find and stated that they were able to compare and evaluate its validity and credibility. Elsewhere, 64% of the students said they were able to screen and control the information they receive. 63% considered themselves able to use a wide range of search strategies, while 49% were able to retrieve, organize and manage content stored by others. Finally, we found that 35% of students knew who to follow in order to share information online.

Regarding the area of **communication**, almost all the students (98.5%) stated that they were able to interact with others through basic communication tools. The figure changes a little when it comes to advanced functions of communication, with 86% stating that they used them and 14% saying they did not. When asked about their use of communication tools, we found that 93.2% of students are able to use a wide range of tools (e-mails, chats, texts, instant messaging, blogs, social networks) and 94.7% declared that they can participate in social networking sites and online communities and can transmit or share knowledge, contents and information.

93.2% of the students said they can collaborate with others using traditional technologies and 98.5% are able to share files and contents with others using simple technologies. The figure drops (85% of those who claimed they were able to) when asked about sharing information, contents and resources actively through online communities, networks and collaboration platforms.

When asked if they were able to create contents in collaboration with others who use simple digital tools, 77% considered themselves able to do this, while 23% stated they were not. The figures change when feeling confident about sharing information and collaborating digitally frequently, with only half of the sample stating that they collaborate with others in the production and distribution of resources, knowledge and contents, compared to 40% who did not do this and 10% who said they did not understand the question.

One essential aspect of online communication is the capacity to adapt the communication and the digital media to the aim sought and to a specific audience. 64% of the students considered they were able to do this and 89% stated they could manage the various types of communication they receive.

As for the rules of net etiquette and appropriate online behavior, 60% knew the basic rules of behavior when communicating with others through digital tools; 34% stated they did not know them, and 6% said they did not understand the question.

Although most students are aware of these basic rules, only 26% consider themselves able to apply the various aspects of online etiquette to the different digital communication spaces and 23% affirmed that they had developed strategies to discover inappropriate behaviors online.

30% of the sample is able to create their digital identity online and monitor their digital fingerprint, while 50% said they could not, and 20% did not understand the question.

When looking at the area **creation of contents** we find that in general the percentages are somewhat lower than in the previous areas

First, when asked if they are able to create simple digital contents, 92% answered affirmatively. When asked about creating contents in various forms (e.g. tables, text, images and audio) 88% said they were able to. Just over half (56%) could create contents in different formats and for different platforms and environments, while half declared that they can remix existing content elements to create new ones. The figures continue to fall when editing content, since just 36% said they were able to use a variety of digital tools to create original multimedia outputs; 43% said they could not and 21% said they did not understand the question. Something similar occurs when editing software, Almost half the students (47%) indicated that they were able to manage the simplest functions (apply basic adjustments). As for advanced modifications of configurations, just 20% declared that they knew how to apply them. They were also asked if they were able to edit (open) programs, modify, change or write source code, write code and program in various languages. 30% stated that they could.

The creation and editing of contents is closely related to knowledge of licenses and author rights. Most students (93%) said they were aware that some contents were protected by copyright and authors' rights, while 7% said that they were unaware of this. When asked about their basic knowledge of the differences between authors' rights and copyright or authors' rights, copyleft and Creative Commons, 42% said that they were familiar with these differences, 55% said they were not, and 3% did not understand the question. Finally, students were asked if they knew how to apply different types of licenses to information and resources that they created and used. 26% answered affirmatively, 65% negatively and the remaining students claimed not to understand the question.

The fourth area in the questionnaire covered **safety**. When asked if they were able to take basic precautions to protect their devices, (e.g., antivirus, passwords,) 94% said that they were. Just over half (56%) knew how to protect their digital devices and how to update strategies, but only 37% actually put them into practice.

As for safety and privacy, 90% stated that they were aware that only certain types of personal information and others can be shared online. 62% said that they understood privacy issues and had basic knowledge about gathering and using their data online, while 38% said they did not. 65% stated that they knew how to avoid cyber bullying.

The majority (95%) are aware that technology can affect their health when used incorrectly and 87% understand the positive and negative effects of using technology for the environment.

The last block of the questionnaire referred to **problem solving** and seeking help. 91% said they were able to ask for specific help when technologies did not work or when using a new device, program or application, and that they were also able to use new technologies to solve routine tasks (92%). Almost all the students (95.5%) are aware of their limitations when using new technologies.

Elsewhere, 81% of the students said they can take decisions when choosing a tool for a routine practice.

Lastly, we find that 94% of the students state they can use technologies to perform creative activities and solve problems. Moreover, 75% claim they can learn something new from them.

4.3 The DIGCOM questionnaire and the tasks performed

Below we present the results from the second questionnaire.

In general, the students perceived that the tasks helped to improve their competencies in all aspects included in the DIGCOM questionnaire.

Focusing on each of the areas, we find that **information** is the area in which students felt their digital competencies had improved most with each of the tasks performed. In task 2 students had to study the concept of 2.0 in depth. This was the activity that the highest number of students considered had improved their digital competence in information, with 94% saying they totally agreed/agreed that the task has helped them. Task 4, social networks and digital identity, was also rated as having been positive highly, with 92.5% answering totally agree/agree. The list continued with tasks 1 (92%), 3 (90%) and 5 (86.5%), accessing, organizing, analyzing, etc... digital information.

In the area of **communication**, students also reported a clear improvement in their digital competence. The highest rated task was for number 4, where 95% totally agreed or agreed with its usefulness. Next was task 2 (91%), then task 3 (on integration of ICT tools in the classroom) with 89.5%, task 5 (on PLEs) with 83.5% and finally task 1, on educational issues in the society of knowledge where 77% expressed total agreement or agreement that it had helped them to improve.

The third area had to do with **creation of contents**. The tasks that most students answered totally agree or agree were 2 (94%), 4 (91%) and 5 (90%). These were followed by task 3, with 89.5%, and task 1, with 77%.

The fourth aspect evaluated with the DIGCOM questionnaire, asked students about **safety**. Although the responses were fairly positive, this was, nevertheless, the area in which students felt they had made least improvements. As expected, given its content, task 4, was the most highly rated, with 95% of the students starting total agreement or agreement that the task had served to enhance their digital competence in relation to online safety and digital identity. Task 3, on ICT integration in the classroom, appears as that which helped the students least, with 35% declaring neither agreement nor disagreement regarding the usefulness of the task. A similar situation occurs with task 5, where 31% showed themselves to be indifferent.

Finally, **problem solving**, which is the most crosscutting of all the areas. As in the previous areas, the tasks were positively rated, with the highest percentage of students agreeing totally or agreeing that the tasks that helped them with problem solving were tasks 4 (89.5%), 2 (89%), 3 and 5 (82%) and, finally task 1, where 24% were indifferent regarding its usefulness in improving their relation with online safety.

5 CONCLUSIONS

The results from the DIGCOM questionnaire on students' perception of their digital competence reveal that they consider themselves to be competent mainly in aspects related to information, communication, and problem solving. Moreover, they rate their competence quite highly in the most basic and general aspects (level 1) but this falls as the level of complexity increases (levels 2 and 3).

The tasks used in this experience were rated very positively by the students, with all the tasks helping to improve their digital competence to a large degree. Tasks 2 and 4 (on web 2.0 and social networks and digital identity, respectively) were

highlighted by the students for the improvement gained in the five areas of digital competence. Although the design of all the tasks took into account all aspects of digital competence to a greater or lesser degree, it is notable that tasks 2 and 4 were the most complex and complete, but at the same time the ones in which the best results were obtained, which may account for their high ratings..

Special mention needs to be made regarding the area of safety since, in the opinion of the students this was the area in which they improved least (except in task 4 which worked specifically on this content). We would highlight the transversality of this area, which has to do with the protection of information and personal data, the protection of digital identity and the security measures taken, as well as the responsible use of technologies and the Internet. Although the other tasks sought to envisage all the above, and despite a general security premise in all the subject, it is highly likely that the students did not perceive the tasks as being very useful for improvement in this sense.

Overall, we observe that the experience was positively viewed by the students in terms of improving their digital competence. Due to the complexity of the students' competencies, these can only be successfully developed through experiences in which the student is at the center of the process. While we are convinced that much remains to be done in this sense, this experience offers an approach to away of working that students have considered to be positive.

6 DISCUSSION

Training centered on competencies is present in all levels of education and it is a clear commitment in line with education policies (LOMCE, 2013). Of the various competencies that citizens need to function in society, digital competency stands out and is transversal, since it helps in mastering other competencies, such as language and mathematics (Ferrari, 2013). The above leads us to the study made here, in which we have been able to describe how first year university students perceive their digital competence. This information has a twofold importance. First, we understand that the individuals need, above all, to master changing technologies and to understand the huge amounts of information available if they are to function well in the world (OECD, 2011). The students who participated in this research had just finished their Secondary education, and are therefore expected to have quite a high level of digital competence which the education system should have given them in order for them to be able to face up to the challenges of society and the technology found in the labor market (Levy, 2010).

We have been able to see that students perceive themselves as having a quite basic level of digital competence, since the aspects in which they see themselves as competent correspond to the first levels of the DIGCOM model. For the second and third levels, the self-perception of competence drops considerably. We therefore agree with Gisbert & Esteve (2011) whose study of digital competence in university students led them to affirm that when students arrive at university they have a basic level of digital competence, with knowledge of some ICT tools, but they have yet to acquire the competencies necessary to master these tools in the educational environment and in their professional development.

Our study also looks at the digital competence of teachers, given that we have worked with first year Primary Education degree students, in other words, future teachers.

The training of the teachers is a key element for the effective development of students' digital competencies that will enable them to use technology appropriately and effectively by adapting it to their students and to the learning they must carry out (Aslan & Zhu, 2015; Gisbert & Lázaro, 2015; Woodruff, Martin, & O'Brien, 2015). We agree with McClintock (2007) when he talks of the usefulness and importance of digital technologies in the intellectual endeavor of educators, as they are fundamental resources for generating, disseminating and employing knowledge, values and skills in life. Related to the above, we now arrive at the second part of our study in which, after designing and applying a series of tasks directed at improving students' digital competence, we observe how they perceive a considerable improvement in this after following the ICT block of the subject.

We are aware that throughout this study we have referred to the students' self-perception and not to real data about their level of digital competence. With a view to overcoming this limitation, we are working on a line of research that will enable us to ascertain the real level of digital competence through the design and preparation of a certification tool (Gutiérrez & Durán, 2014)- In future courses we will be able to repeat this type of study but without the type of possible limitations detected in this one.

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